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(54) Title: THERMOSTABLE AND LIGHTFAST DICHROIC LIGHT POLARIZERS

(57) Abstract

Polarizing coatings are formed from dyestuffs which provide a stable liquid crystalline phase in a wide range of concentrations, temperatures and pH-values. Particles formed by aggregates of the liquid crystal molecules are oriented in a predetermined direction to polarize light. The stability of the liquid crystalline state allows orienting the particles by mechanical forces such as a shearing force applied when the liquid crystal (10) is spread on a support surface (20) by a knife-like doctor (90) or a tension deformation force acting on the meniscus of the liquid crystal deposited between two surfaces (20, 30) as the surfaces are peeled off one another. As a result, the polarizing coatings are formed in some embodiments by simple methods. In some embodiments, the polarizing coatings have a high lightfastness, a high thermal stability, and a high dichroic ratio.

WE CLAIM:

1. A dichroic polarizer comprising a water soluble organic dyestuff of the formula:

{Chromogen} $(SO_3M)_a$

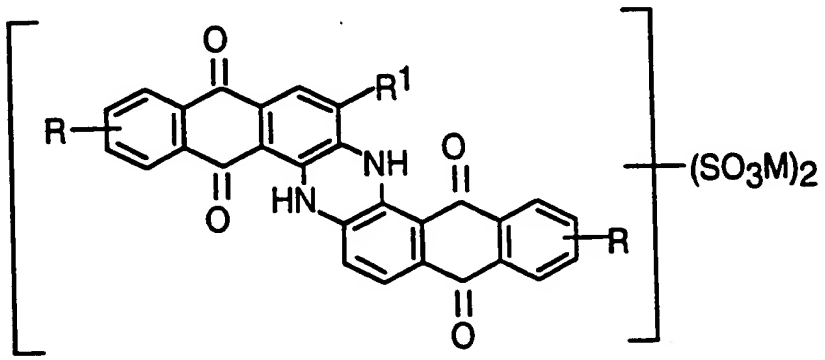
wherein:

the Chromogen is such that the dyestuff is capable of existing in a stable liquid crystalline phase;

M is a cation; and

the dyestuff comprises molecules agregated into particles that are oriented in a predetermined direction to enable the dyestuff to polarize light if the light is transmitted through the dyestuff.

2. The dichroic polarizer of Claim 1 wherein th dyestuff has the formula:



wherein:

R^1 = H or Cl;

R = H, Alk, ArNH, or ArCONH;

Alk is an alkyl group; and

Ar is a substituted or unsubstituted aryl radical.

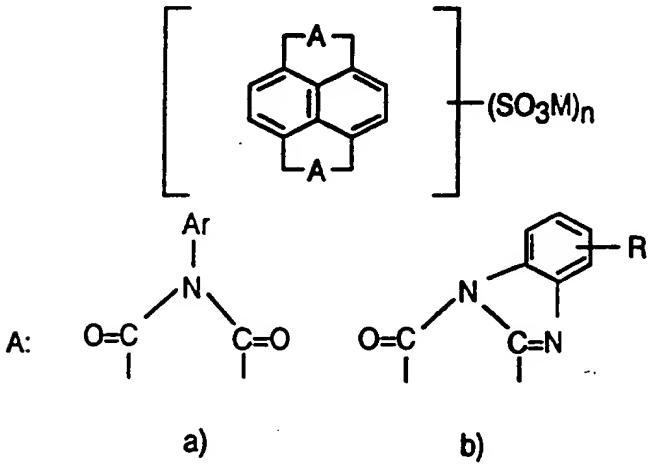
3. The dichroic polarizer of Claim 2 wherein Alk is an alkyl group with 1 to 4 carbon atoms.

4. The dichroic polarizer of Claim 3 wherein Alk is one of CH_3, C_2H_5.

5. The dichroic polarizer of Claim 2, 3 or 4 wherein Ar is a substituted or unsubstituted phenyl radical.

6. The dichroic polarizer of Claim 5 wherein Ar is one of C_6H_5, $4\text{-}ClC_6H_4$.

7. The dichroic polarizer of Claim 1 wherein the dyestuff has the formula:



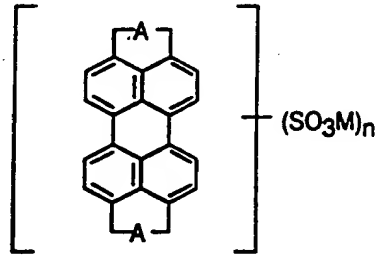
wherein

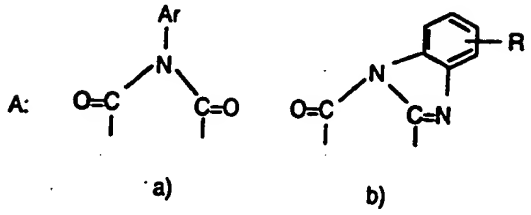
R is H, an alkyl group, a halogen, or an alkoxy group;

Ar is a substituted or unsubstituted aryl radical; and

n = 2 or 3.

8. The dichroic polarizer of Claim 1 wherein the dyestuff has the formula:





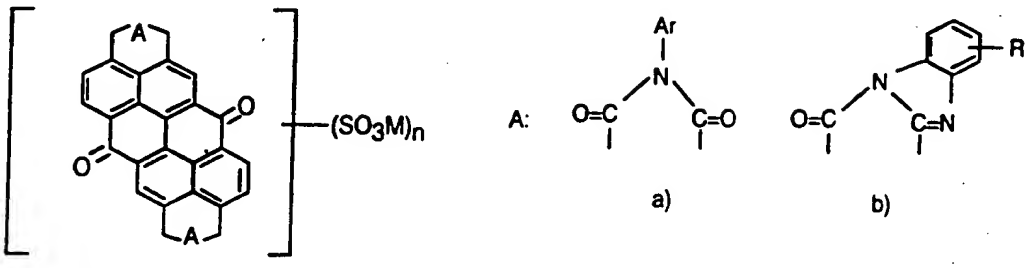
wherein:

R is H, an alkyl group, a halogen, or an alkoxy group;

Ar is a substituted or unsubstituted aryl radical; and

n = 2 or 3.

9. The dichroic polarizer of Claim 1 wherein the dyestuff has the formula:



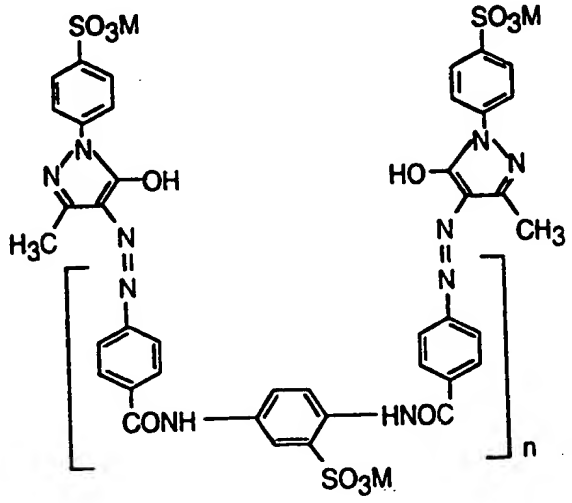
wherein:

R is H, an alkyl group, a halogen, or an alkoxy group;

Ar is a substituted or unsubstituted aryl radical; and

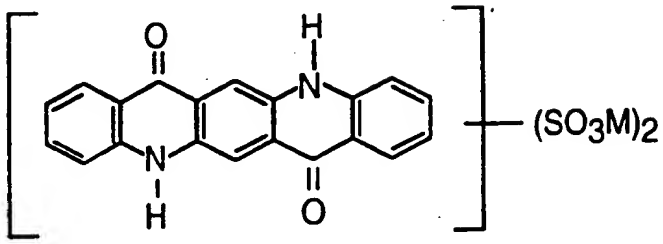
n = 2 or 3.

10. The dichroic polarizer of Claim 1 wherein the dyestuff has the formula:

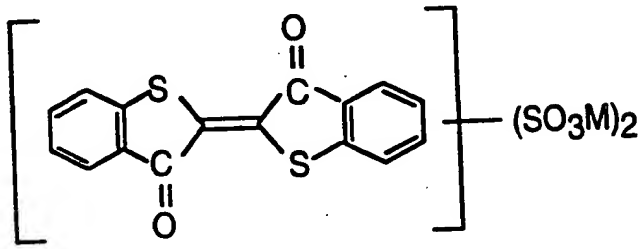


wherein n = 3, 4 or 5.

11. The dichroic polarizer of Claim 1 wherein the dyestuff has the formula:



12. The dichroic polarizer of Claim 1 wherein the dyestuff has the formula:



13. The dichroic polarizer of Claim 7, 8 or 9 wherein:

R is H; or an alkyl group with 1 to 4 carbon atoms; or an alkoxy group with 1 to 2 carbon atoms; or Br; or Cl.

14. The dichroic polariz r of Claim 13 wh r in R is CH_3 or C_2H_5.

15. The dichroic polarizer of Claim 13 wherien R = CH_3O.

16. The dichroic polarizer of one of Claims 7-9, 13-15 wherein Ar is a substituted or unsubstituted phenyl radical.

17. The dichroic polarizer of Claim 16 wherein R is C_6H_5, 4-$CH_3OC_6H_4$, 4-$C_2H_5OC_6H_4$, 4-ClC_6H_4, 4-$C_4H_9C_6H_4$, or 3-$CH_3C_6H_4$.

18. The dichroic polarizer of one of Claims 1-17 wherein M is H^+, a metal of the first group, or NH_4^+.

19. The dichroic polarizer of Claim 18 wherein M is H^+, Li^+, Na^+, K^+, Cs^+, or NH_4^+.

20. A process for making a light-polarizing element, the process comprising the steps of:

forming a solution of a dyestuff on a surface of a support wherein the dyestuff is in a liquid crystalline state;

orienting, by an orienting force, molecules or supra-molecular complexes of the dyestuff in th liquid crystalline stat in a predetermined

direction to enable the dyestuff to polarize transmitted light;

removing the orienting force, the molecules or supra-molecular structures remaining oriented and the dyestuff remaining in the liquid crystalline state; and

evaporating a solvent from the solution while the molecules or supra-molecular complexes of the dyestuff remain oriented.

21. The process of Claim 20 wherien the orienting force is a shearing force.

22. The process of Claim 21 wherein the shearing force is applied by a doctor moving relative to the support surface, the doctor being in contact with the solution.

23. The process of Claim 20 wherein the orienting step comprises the step of tension deformation in a meniscus of the dyestuff solution during a wedging separation of the support surface from another surfac contacting the dyestuff solution.

24. The process of Claim 23 wherein the support is a flexible film, the other surface is a surface of anoth r fl xible film, and the t nsion def rmati n in

the meniscus is created as the two flexible films are being separated from each other.

25. The process of Claim 23, wherein the support surface is a hard surface and the other surface is a surface of a flexible film.

26. The process according to Claim 23, wherein the other surface is a surface of a cylinder rolling relative to the support surface.